

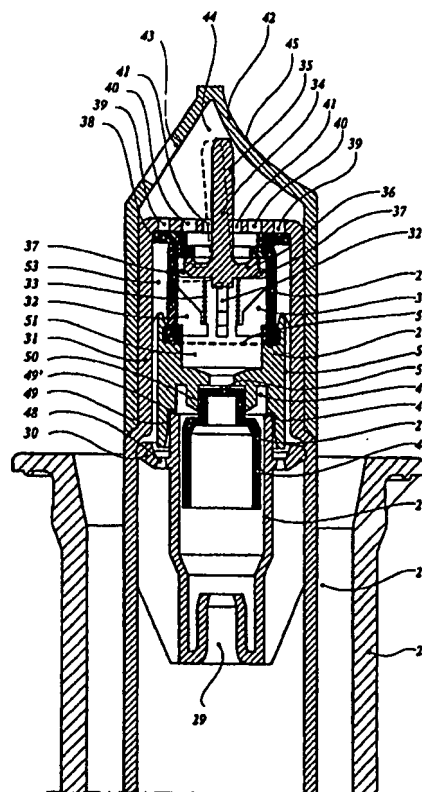
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>5</sup> :</b>  <b>B05B 7/00, 7/24</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 94/21384</b>  <b>(43) International Publication Date:</b> 29 September 1994 (29.09.94)
<b>(21) International Application Number:</b> PCT/NL94/00064  <b>(22) International Filing Date:</b> 23 March 1994 (23.03.94)  <b>(30) Priority Data:</b> 9300517                      23 March 1993 (23.03.93)                      NL  <b>(71) Applicant (for all designated States except US):</b> AIRSPRAY INTERNATIONAL B.V. [NL/NL]; 31-33, Zuiderkade, NL-1948 NG Beverwijk (NL).  <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> VAN DER HEIJDEN, Edgar, Ivo, Maria [NL/NL]; 14, Joh. Huizingastraet, NL-1827 NA Alkmaar (NL).  <b>(74) Agent:</b> BAKKUM, R., J.; Exterpatent B.V., P.O. Box 3241, NL-2280 GE Rijswijk (NL).	<b>(81) Designated States:</b> AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, GE, HU, JP, KP, KR, KZ, LK, LU, LV, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i>	

**(54) Title:** FOAM-FORMING UNIT, SPRAY HEAD SUITABLE THEREFOR, AND AN AEROSOL COMPRISING SUCH A UNIT

**(57) Abstract**

Foam-forming unit, in particular intended for an aerosol, at least comprising a mixing chamber (13; 47), with a propellant inlet (14; 48) and an inlet (15; 29) for a liquid to be dispensed in foam form, which mixing chamber (13; 47) by means of a control valve provided with return means, can be placed in communication with an outlet channel (10; 44) opening out into an outflow aperture (9; 43), one or more foam-forming parts (8; 52) being present in the path between the inlets and the outflow aperture (9; 43), while the unit also comprises a non-return valve (18, 22; 38, 39) through which an aerosol can be placed under pressure using pressure means, during which operation the outflow aperture (9; 43) is in communication with the pressure means, while valve means are present which interrupt the communication between the foam-forming parts (8; 52) and the environment at least in one direction, which valve means can be opened when the aerosol is to be used for the dispensing of foam and aerosol comprising such a foam forming unit.



**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

Foam-forming unit, spray head suitable therefor, and an aerosol comprising such a unit

The present invention relates to a foam-forming unit, in particular intended for an aerosol.

Foam-forming units are generally known and are used in aerosols for dispensing in foam form a large variety of products such as shaving foam, hair setting agents, cleaning agents, insulation foam etc.

The aerosol contains a liquid to be dispensed in foam form, and a propellant. Both constituents are mixed with each other, and a foam is formed by passing the mixture through one or more foam-forming parts.

The outflow aperture of the abovementioned foam-forming units is generally in the form of a spray nozzle forming part of a spray head which forms the end of the outlet channel. An aerosol with a foam-forming unit is generally operated by pressing with one finger on said spray head.

Foam-forming aerosols working with air as the propellant must be placed under air pressure before use. For this purpose, the foam-forming unit often comprises a non-return valve, through which air can be forced into the liquid container of the aerosol.

In this connection, reference is made to Dutch Patent Application NL-A-77 05241, which discloses a common aerosol with atomizer unit and liquid container which operates with air as a propellant. An annular space present around the atomizer unit and a hollow piston make it possible for the container to be placed under air pressure by pumping. During this pressure operation, the annular space serves as a guide and as a pressure chamber which is in communication with the pressure chamber in the hollow piston. The pressure produced in the pressure chambers during pumping opens a non-return valve present in the atomizer unit, and air is forced into the container. During the pumping operation the outflow aperture is located in

the pressure chamber.

If foam-forming parts were to be fitted in the path of the liquid/gas mixture in such an atomizer unit, the latter could serve as a foam-forming unit, and the aerosol  
5 could thus dispense foam.

When such an aerosol has to be placed under pressure again after a quantity of foam has been dispensed, the outflow aperture is located in the pressure chamber, and therefore during pumping the pressure is also raised in  
10 the outlet channel which is in communication with the outflow aperture. Since residues of foam often remain in said outlet channel after foam has been dispensed, said residues will also be placed under pressure. Due to the pressure increase, the foam residues are compressed first  
15 of all, with the result that expansion occurs on a subsequent lowering of pressure during the movement of the piston in the opposite direction, and the foam residues are foamed again under the influence of the foam-forming parts present, and thus acquire a greater volume. This means that  
20 during pumping foam often passes out of the outlet channel via the outflow aperture in the pressure chamber. The foam-forming unit and the hollow piston may become soiled as a result. The foams formed generally form a sticky layer when they dry and can make pumping with the piston difficult,  
25 and blockage of the outflow aperture or the foam-forming parts may also occur. Since aerosol cans are operated with one finger by pressing on the spray head in which the outflow aperture is located, soiling of the outflow aperture, and thus of the spray head, is also undesirable.  
30 The object of the present invention is to provide a foam-forming unit which does not have the abovementioned disadvantages.

In a first aspect of the invention therefore a foam-forming unit is provided, in particular intended for  
35 an aerosol, at least comprising a mixing chamber, with a propellant inlet and an inlet for a liquid to be dispensed in foam form, which mixing chamber by means of a control valve provided with return means, can be placed in communication with an outlet channel opening out into an

outflow aperture, one or more foam-forming parts being present in the path between the inlets and the outflow aperture, while the unit also comprises a non-return valve through which an aerosol can be placed under pressure using pressure means, during which operation the outflow aperture is in communication with the pressure means, while valve means are present which interrupt the communication between the foam-forming parts and the environment at least in one direction, which valve means can be opened when the aerosol is to be used for the dispensing of foam.

The presence of said valve means ensures that during the pressure operation to place an aerosol under pressure, the pressure is prevented from being raised and lowered alternately at the position of the foam-forming parts. In this way it is ensured that the outflow aperture - and thus the spray head - always remains essentially free from foam residues. An additional advantage which can be mentioned is that in case the valve means are opened only during the dispensing of a foam, foam residues are also prevented from drying in the outflow aperture, the outlet channel and the foam-forming parts.

The valve means are present, to interrupt the communication between the foam forming parts and the environment at least in one direction, as it will be clear from the subsequent description of the invention, that only a pressure increase or a pressure decrease at the position of the foam forming parts does not give rise to the problems described earlier.

The present invention is not restricted to placing under pressure in the manner described in NL-A-77 05241, but also extends to foam-forming units for aerosols which can be placed under pressure by means of, for example, a cap over the foam-forming unit, which cap is in communication with pressure means.

In the present description the liquid to be dispensed in the foam form is not limited to liquids with a low viscosity, but the meaning thereof also extends to more viscous products, or even paste-like products and powder containing products, which are to be dispensed in foam form.

The valve means for interrupting the communication between the foam-forming parts and the environment are preferably formed by the control valve being a non-return control valve.

- 5           Also preferably the non-return valve for placing an aerosol under pressure is formed by the control valve.

In this way the control valve has multiple functions, and the number of components for the foam forming unit according to the invention is reduced. It is possible, as will be described later on with reference to the enclosed drawings, to design the control valve as a non-return control valve, which means that when external pressure is applied to the foam forming unit, the control valve can be opened and a propellant, e.g. air, can be pressed into the unit and aerosol, on which it is mounted. Hereby it is prevented that during a subsequent pump stroke, in which the pressure is lowered frequently even to a negative gauge pressure, the control valve will prevent the pressure at the position of the foam forming parts to be decreased also.

For pressurizing the aerosol, a separate non-return valve can be present, through which the propellant e.g. air is forced into the aerosol, however to reduce the number of components it is advantageous to use the control valve as the non-return valve through which the aerosol is pressurized.

Preferably, the control valve is a tilting valve, which advantageously can interact with a flexible cap, which forms the outlet channel and is provided with an outflow aperture.

This embodiment will be explained in greater detail with reference to the appended drawing.

The unit according to the invention has the advantage that during the pressure operation any foam residues which are present in the outlet channel past the control valve are blown back into the aerosol, while compression and expansion of foam residues are prevented from occurring at the foam-forming parts.

It is particularly advantageous if the tilting

valve comprises a disc-shaped valve body and a stem part, and that the disc-shaped valve body can interact with a sealing ring. Preferably said sealing ring also forms the seal of the non-return valve.

5 In the latter case the seal fulfills two functions simultaneously, which means that only one seal needs to be manufactured and fitted. Depending on the specific design characteristics it can be advantageous either to have only a control valve, which also functions as a non-return valve  
10 through which the aerosol can be pressurized, or that a separate return valve is present, through which the aerosol is pressurized.

Especially in the case in which placing under pressure of the aerosol takes place through the control  
15 valve, it is advantageous that the unit comprises a second non-return valve upstream of the control valve, seen in the intended direction of flow of foam, which has the function of connecting the outlet channel, during placing under pressure of an aerosol, directly with the interior of the  
20 aerosol, bypassing the propellant inlet and liquid inlet.

If an aerosol is placed under pressure through the control valve, the propellant must be forced through the propellant inlet and liquid inlet, which usually are relatively narrow and therefore the force required to press  
25 the propellant through said channels is relatively high. The presence of a second non-return valve obviates said increased force, as this will be opened at a certain pressure, which is relatively low.

In this respect it is noted, that in the foam forming  
30 unit according to the invention preferably a third non-return valve is also present, which can be designed as a ball, to interrupt the communication between the outlet channel and the propellant inlet and liquid inlet during pressurization, to prevent the propellant to pass through  
35 said inlet. In this way residual liquid present upstream of the third non-return valve will not be blown back into the aerosol, which has the advantage that when using the aerosol again after pressurizing it, the time, which will lapse between opening the control valve and dispensing foam

will be reduced.

The valve means for interrupting the communication between the foam forming parts and the environment at least in one direction can also be designed in many other ways and in other preferred embodiments these are present in the outlet channel downstream of the control valve, seen in the intended direction of flow of foam.

The valve means then are advantageously in the form of a rotary or slide valve in the outlet channel, which valve is connected to the control valve and provided with return means. These valve means open at the moment at which the control valve is depressed. The communication between the outlet channel and the environment is thus always interrupted when the foam-forming unit is not in use.

The valve means can also be made independent of the control valve, in which case the valve means are then preferably in the form of a non-return valve. A particularly practical embodiment of this is a ball biased by means of a spring in a direction opposite to the intended direction of flow of foam. A non-return valve is understood to mean a valve which is opened at an adjustable pressure. In other words, such a valve is always closed until the control valve is depressed and the foam-forming unit is put into operation, and the pressure of the mixture to be dispensed is sufficiently high.

The pressure decreases during use particularly in the case of aerosols operating with air as the propellant. When the pressure in the aerosol becomes too low and the non-return valve closes, this is a warning to the user that the aerosol must be placed under pressure again.

Another embodiment of the unit according to the invention is one in which the sealing means are in the form of a rotary valve provided with return means, which valve comprises a cylindrical part which has a passage which through rotation can place the outlet channel in communication with the environment, in such a way that the rotary valve is opened when the control valve is moved. This and preceding embodiments will be explained in greater detail in the description of the drawing given below.



The invention also provides a spray head, at least comprising an outlet aperture and a channel in communication therewith, which spray head is characterized in that it comprises foam-forming means and/or valve means of  
5 the type described in one or more of claims 9 - 13.

Finally, the invention provides an aerosol, at least comprising a container placed under pressure or to be placed under pressure, and a foam-forming unit, which aerosol is characterized in that the abovementioned foam-  
10 forming unit is a foam-forming unit according to the invention.

The invention will now be explained in greater detail with reference to the appended drawing, in which:

Fig. 1 shows a diagrammatic section of an aerosol  
15 according to the prior art;

Fig. 2 shows a diagrammatic section of a first embodiment of a foam-forming unit according to the invention;

Fig. 3a shows a perspective view of an embodiment  
20 of a spray head according to the invention, with rotary valve;

Fig. 3b shows a section of the spray head according to Fig. 3a;

Fig. 4a shows a perspective view of another  
25 embodiment of a spray head according to the invention, with slide valve;

Fig. 4b shows a section of the spray head according to Fig. 4a;

Fig. 5a shows a front view of a spray head accord-  
30 ing to the invention, with diaphragm seal;

Fig. 5b shows a cross-section of the embodiment according to Fig. 5a;

Fig. 6 shows a section of a spray head according to the invention, with a ball valve;

Fig. 7a shows a perspective view of an embodiment  
35 of the aerosol according to the invention, with a swing valve closure;

Fig. 7b shows a section of the embodiment according to Fig. 7a;

Fig. 8 shows a section of another embodiment of the aerosol according to the invention, with a slide valve; and

Fig. 9 shows a diagrammatic section of yet another embodiment of a foam forming unit according to the  
5 invention.

Fig. 1 shows diagrammatically an atomizer unit 1 according to the prior art, which can be accommodated in an aerosol 2 by wedging it between a cap 3 and a neck 4 of the aerosol 2. Such an atomizer unit is described in NL-A-77  
10 05241.

The atomizer unit comprises an annular space 6 which is surrounded by a wall 5 and can serve as a first pressure chamber. A spray head 7 is also present. Foam-forming parts can be disposed in the spray head, in order  
15 to make the atomizer unit a foam-forming unit. Examples of such foam-forming parts are shown here as two small screens 8.

The outflow aperture is indicated by 9. Said outflow aperture 9 is in communication with an outlet  
20 channel 10 which is present in a part 11 of the control valve and is provided with a spring 12. When the spray head 7 is depressed against the action of the spring 12, the outlet channel 10 is placed in communication with a mixing chamber 13 which is in turn in communication - by way of  
25 air supply channels 14 and liquid supply channel 15 - with the interior of the aerosol 2. The liquid supply channel 15 is connected to a riser tube 16, which projects into the liquid. For a good seal between the part 11 and the wall 17, a sealing ring 18 is present. The fastening of said  
30 sealing ring to the wall 17 is indicated by 18'.

A piston 19, with a transverse flange 20 lying closely against the inside of the wall 5, is also shown.

Said piston 19 is often made integral with a cap covering the cover 3.

35 When the piston 19 is moved downwards, the air present in the space 6 and in the chamber 21 is forced into the aerosol through channels 22, which are kept closed by the seal 18 during the return stroke of the piston and during use of the aerosol. During the pressure-increasing

pumping stroke, said seal can move away slightly from the wall 17, in order to let air through.

When such an atomizer unit is used for forming foam, foam is often present in the outlet channel 10 between the screens 8 and extends to before the nozzle 9. When the piston 19 is moved downwards in the annular space 6, a pressure increase will occur in said space and in the pressure chamber 21, which pressure increase also occurs in the outlet channel 10. When an upward movement of the piston causes the pressure to decrease again, or even causes a negative gauge pressure to occur, the foam compressed in the pressure-increasing stroke will again expand to a greater volume through the screens 8 and emerge out of the nozzle 9, with the adverse soiling consequences discussed earlier. A greater volume is intended to mean a volume of foam greater than originally present before the compression, i.e. the pressure increase, stroke of the piston.

Fig. 2 shows a first embodiment of a foam-forming unit according to the invention, with the same pump mechanism as the atomizer unit according to Fig. 1. Here again, an outside wall 23 with an annular space 24 is present, in which space a piston can be moved up and down so that an aerosol formed with the unit can be placed under pressure.

In this embodiment, the foam-forming unit comprises four parts 25, 26, 27 and 28. The part 25 has on the underside an aperture 29 in which an immersion tube can be fixed. This part 25 also lies closely against the inside of the wall 31 at 30.

The part 27 comprises a number of lobes on the outside, which lobes rest against the inside of the wall 31, in order to centre this part and to form channels 54.

The part 28 in this case contains four wings 32, which form a support for a spring 33. The spring 33 forms the return means of a valve disc 34 of a tilting valve.

The valve disc 34 has a projecting stem part 35, a dish-shaped part 36 with raised edge, and a number of positioning lobes 37 which centre the valve disc by resting

against the inside of the part 28. The valve disc 34 lies with the raised edge of the dish-shaped part against a sealing ring 38.

The wall 31 is provided at the top side with a number of apertures 39, 40 and 41. The stem part 35 of the valve body 34 projects through the aperture 41. The aperture 40 serves to allow through foam which has formed. Finally, aperture 39 with sealing ring 39 forms a non-return valve.

10 A flexible cap 42 surrounds the foam-forming unit at the top side. The latter has an outflow aperture 43 and defines an outlet channel 44.

In the following description of how the unit works it is assumed that the unit is fixed on an aerosol container, and that the container contains liquid to be foamed and air under pressure.

When pressure is applied to the cap at the position of 45, the valve body 34 is moved to the position indicated by dashed lines. The control valve is opened at that moment. Liquid will flow via the riser tube (not shown) through the aperture 29 and an annular space 46 into a mixing chamber 47. The annular space is formed between the outside wall of the part 26 and the inside wall of the part 25. Propellant flows, via passages 48 present in the part 25 and channels 49, 49' formed by grooves in the outer surface and the end face of the part 25, also into the mixing chamber 47, where it mixes with the liquid.

The mixture then flows via channels 50, 50' to a space 51. The channels 50, 50' are formed by grooves in the part 26. There is additional mixing in the space 51, which also contains a screen 52 through which the mixture is foamed. Finally, the foam formed passes via the tilting valve and the outlet channel 44 through the outflow aperture 43.

35 The use of a mixing chamber as described, has the advantage that the amount of air necessary for producing foam is reduced when compared with state of the art foam formers. In this regard reference is made to NL-A-8901877 of applicant, disclosing such a mixing chamber.

An aerosol container on which the unit can be mounted is placed under pressure as follows. Air is forced into the aerosol via the non-return valve 38, 39, annular spaces 53 and channels 54 and, finally, apertures 48, by moving a piston 19 of the type shown in Fig. 1 above the atomizer unit up and down in the annular space 24. Any foam residues left behind in the outlet channel 44 are also forced into the container.

In the case of the foam-forming unit shown in Fig. 2, it is ensured that a pressure rise and a pressure fall do not occur alternately over the foam-forming unit (screen 52) during the pumping (placing the container under pressure), with the disadvantages described in the introduction. The outlet channel also has foam residues cleared from it, so that possible blockages are avoided. When the pressure becomes so high that the spring tension of the spring 33 is exceeded, the tilting valve will be opened slightly, but without adverse consequences, since it is closed again when the pressure subsequently falls.

The next figures show embodiments of spray heads according to the invention containing valve means, and suitable for mounting on conventional atomizer units. Of course, they can also be integral with the atomizer unit, or they can be detachable. They are all suitable for the unit shown in Fig. 1, but also for other units which are placed under pressure in a similar way, i.e. in which the outflow aperture is situated in the pressure chamber during the operation of placing under pressure. An example which could be given is aerosols with a quick-action coupling mechanism, in which the spray head and a part of the aerosol container itself are placed in a space which can be placed under pressure by way of the non-return valve. Similar problems will occur in this case. The latter pressure operation is also suitable for the foam-forming unit shown in Fig. 2.

Figs. 3a and 3b show a first embodiment of a spray head according to the invention, in which a rotary valve 55 with a spring 56 as the return means is used, the rotary valve 55 comprising an operating lip 57 which interacts

with said spring 56. The rotary valve also comprises a passage 58 which can place the outlet channel 10 in communication with the environment when the lip 57 is depressed. A suitable mode of operation can be obtained depending on the spring tension of the spring 56 and the spring tension of the spring 12 of Fig. 1. For example, the valve 55 can be opened first of all, before the channel 10 is placed in communication with the mixing chamber 13.

Fig. 4a and 4b show another embodiment of a spray head according to the invention, with a slide valve comprising a slide part 59 with a tapering recess 60, which slide part 59 is held in a closed position by a spring 61. An operating grip 62, comprising a pin 63 which can interact with the slanting side of the recess 60 of the slide part 59, is present. The operating grip 62 is also connected to the spray head 7 by means of a hinge 64. Here again, the spring tension can be set in a suitable manner according to the envisaged purpose.

Figs. 5a and 5b show an embodiment of the spray head according to the invention with a non-return valve which consists of a diaphragm 66 which contains apertures 67 and is pressed against the spray head 7 by means of an annular part 65. When the pressure from the outlet channel 10 increases, the diaphragm will move away slightly from the spray head 7 and clear the apertures 67, with the result that the foam can be dispensed. However, pressure from the outside closes the apertures 67.

Fig. 6 shows an embodiment of the spray head with non-return valve in the form of a ball 69 which is biased by means of a spring 68 and shuts off the outlet channel 10. When the pressure in the outlet channel 10 from the aerosol exceeds the tension of the spring 68, the ball will be lifted slightly, with the result that foam can be dispensed.

Fig. 7a and 7b show a very simple embodiment of a spray head according to the invention, comprising a swing valve 70 with a lip 71, which valve can shut off the outflow aperture 9 by interacting with projections on the spray head 7. The arrow A indicates how said valve opens,

and the open position is indicated by dashed lines. The dimensions of the lip 71 are preferably selected in such a way that in the open position the piston 21 cannot be pushed over the spray head. This is to ensure that the aerosol is not placed under pressure while the swing valve 70 is still in the open position.

Fig. 8 shows another embodiment of the spray head with a slide valve, in which the sliding head 7 can in fact be moved over the outlet channel 10 against the action of a spring 72 in order to place the outlet aperture 9 in communication therewith. In order to ensure a good seal, a sealing ring 73 is present around the end of the outlet channel 10. Here again, the tension of the spring 72 can be selected in such a way relative to the tension of the spring 12 that during use one of the two valves is opened earlier, preferably the slide valve first of all.

Finally fig. 9 shows a preferred embodiment, which is a modified version of the embodiment according to fig. 2. Therefore similar components have been designated with similar reference numerals. The foam forming unit comprises again four parts, 25, 74, 75 and 76. The part 76 again contains a number of wings 32, by which the spring 33 is supported, forming the return means of the valve body, comprising a disc-shaped part 36 and a stem part 35. The disc-shaped part again has a raised edge, which lies against a sealing ring 77.

Further the wall 31 on the top side has a number of apertures 40 through which foam, which has been formed, can pass into the outlet channel 44 and out of the outflow aperture 43.

The supply of propellant and fluid is altered in this embodiment, compared with the embodiment of fig. 2 in that the part 26 is not present. The liquid can flow through the riser tube 15 into the part 25 and in the upper part thereof it is mixed with propellant, which is supplied via passages 48 and channels 49, 49'. Further said mixture will flow through the aperture 78 in the part 74 and through the screen 52.

In this embodiment, a second non-return valve is

present, which comprises an aperture 79 and a sealing ring 80.

Also a third non-return valve is present, in the form of the ball 81.

5           If an aerosol onto which the foam forming unit according to fig. 9 is mounted has to be brought under air pressure, the piston 19 can be moved up and down, and during the downward stroke air will be pressed into the unit via the outlet aperture 43, enters the apertures 40  
10 and the raised edge of the disk-shaped part of the tilting valve will be lifted from the sealing ring 77. Further the ball 81, which is however not absolutely necessary, will be pressed into the channel 82 and will therefore close off the connection between the liquid and propellant inlet and  
15 the outlet. The air will then pass through the aperture 79 and will lift the ring 80 from the seat 83 and will enter the aerosol container via channels 48. It will be clear that as a result of the presence of the ball 81 the space in channel 82 and component 25 will not be emptied, i.e. a  
20 mixture of liquid and air will remain therein. The time, which will lapse as from the moment the tilting valve is actuated until the moment on which foam is dispensed, is reduced, compared with other embodiments, in which all of the unit is cleaned by the air pressed through the unit.

25           Preferably the channel 49' and passages 78 are not aligned, so that air supplied via the passages 49' is not directly blown into the apertures 78. Usually 2 to 10 of these channels and passages are present most preferably four channels, two passages.

30           In using the tilting valve is actuated by pressing on the part 42, and foam is formed in the usual way as described with reference to fig. 2.

          The sealing ring 80 is biased against the annular shoulder 83 and will also be pressed against said shoulder  
35 by the internal pressure of the aerosol.

          In a preferred embodiment the part 45 of the cap 42 is designed as a convex part instead of concave as shown in fig. 2 and 9. If a convex shape is used, this part will be compressed when dispensing foam, reducing the volume of the



outlet channel 44. When dispensing is interrupted the control valve is closed and the part 45 will return to its original convex shape with a resulting volume increase of the channel 44. This volume increase sucks foam from the outlet aperture 43 into the channel 45, whereby the aperture 43 is cleaned and foam residues near the aperture 43 are removed.

Claims

1. Foam-forming unit, in particular intended for an aerosol, at least comprising a mixing chamber (13; 47), with a propellant inlet (14; 48) and an inlet (15; 29) for a liquid to be dispensed in foam form, which mixing chamber  
5 (13; 47) by means of a control valve provided with return means, can be placed in communication with an outlet channel (10; 44) opening out into an outflow aperture (9; 43), one or more foam-forming parts (8; 52) being present in the path between the inlets and the outflow aperture (9;  
10 43), while the unit also comprises a non-return valve (18, 22; 38, 39) through which an aerosol can be placed under pressure using pressure means, during which operation the outflow aperture (9; 43) is in communication with the pressure means, while valve means are present which interrupt  
15 the communication between the foam-forming parts (8; 52) and the environment at least in one direction, which valve means can be opened when the aerosol is to be used for the dispensing of foam.

2. Foam-forming unit according to claim 1, **characterized in that** the valve means for interrupting the  
20 communication between the foam-forming parts (8; 52) and the environment are formed by the control valve being a non-return control valve.

3. Foam-forming unit according to claim 1 or 2,  
25 characterized in that the non-return valve (18, 22; 38, 39) for placing an aerosol under pressure is formed by the control valve.

4. Foam-forming unit according to one or more of claims 1 - 3, **characterized in that** the control valve is a  
30 tilting valve (34).

5. Foam-forming unit according to claim 4, characterized in that the tilting valve (34) can interact

with a flexible cap (42) which forms the outlet channel (44) and is provided with an outflow aperture (43).

6. Foam-forming unit according to claim 4 or 5, characterized in that the tilting valve comprises a disc shaped valve body (36) and a stem part (35), and that the disc shaped valve body (36) can interact with a sealing ring (38).

7. Foam-forming unit according to claim 6, characterized in that, the sealing ring (38) also forms the seal of the non-return valve (38, 39).

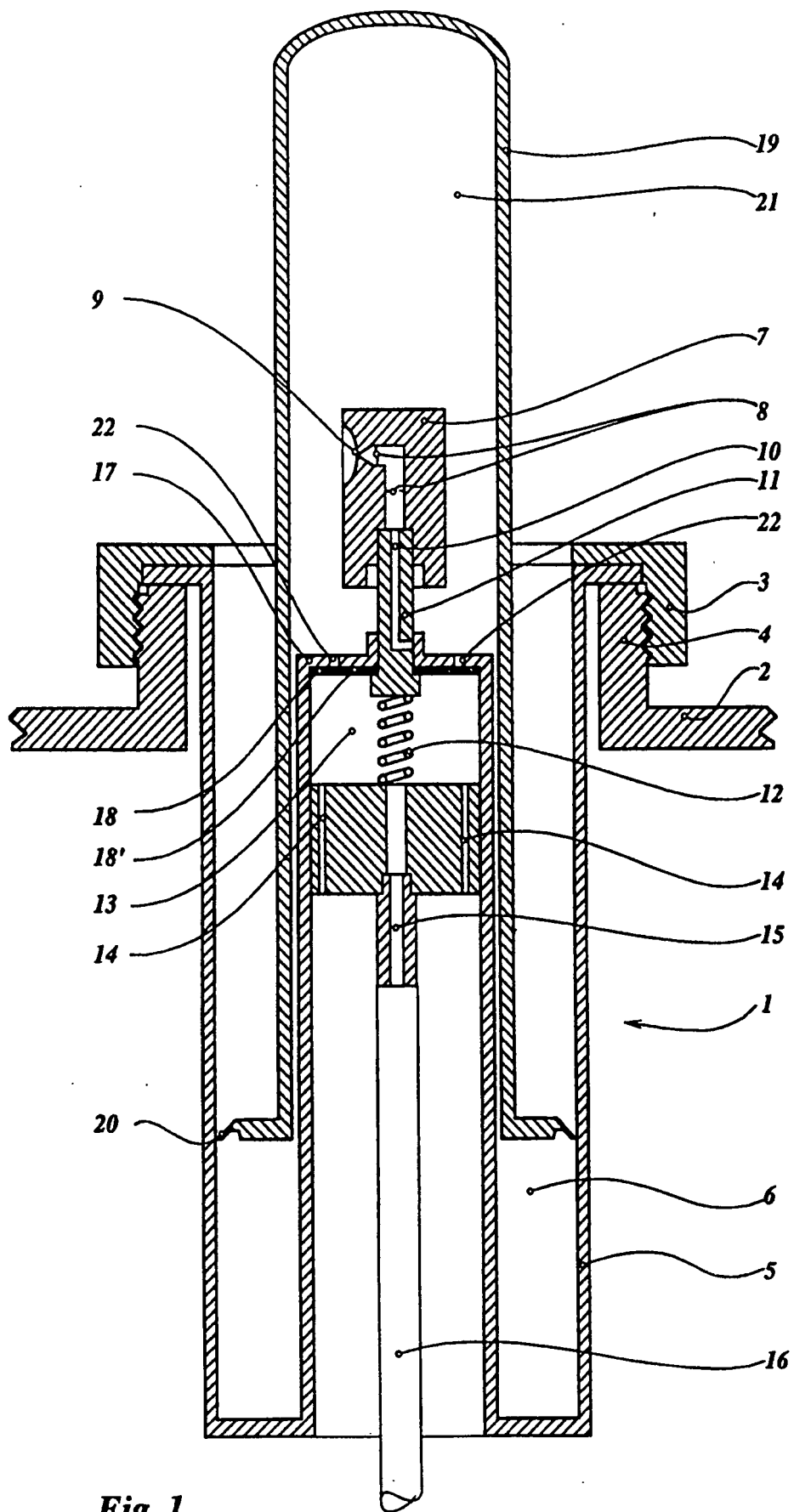
8. Foam-forming unit according to one or more of the preceding claims, characterized in that the unit comprises a second non-return valve (80, 83) upstream of the control valve, seen in the intended direction of flow of foam, which has the function of connecting the outlet channel (44), during placing under pressure of an aerosol, with the interior of the aerosol, by-passing the propellant inlet (48) and the liquid inlet (29).

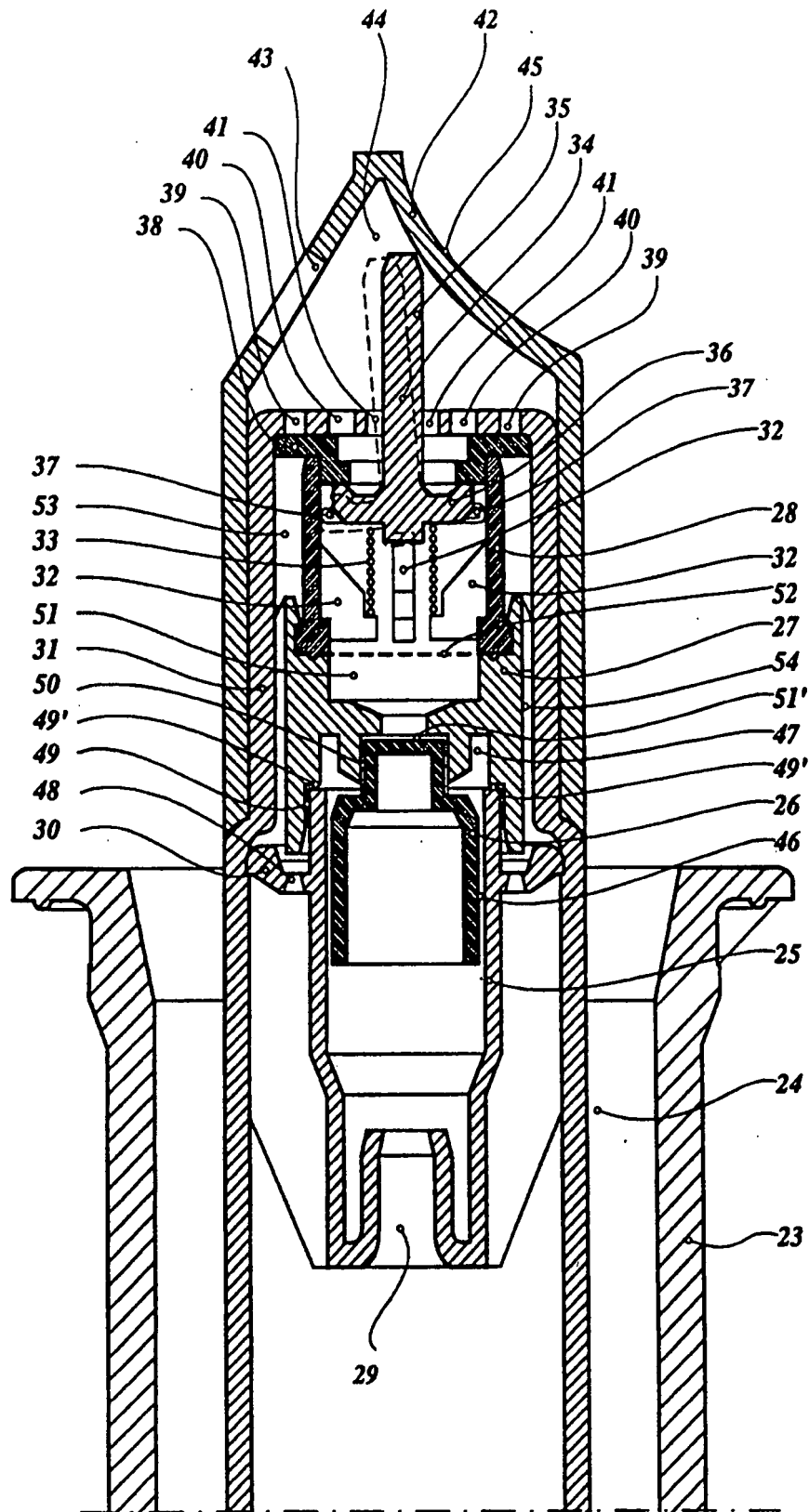
9. Foam-forming unit according to claim 1, characterized in that the valve means for interrupting the communication between the foam-forming parts (8; 52) and the environment at least in one direction are present in the outlet channel downstream of the control valve, seen in the intended direction of flow of foam.

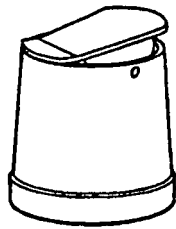
10. Foam-forming unit according to claim 9, characterized in that the valve means are in the form of a rotary or slide valve in the outlet channel (10; 44), connected to the control valve and provided with return means.

11. Foam-forming unit according to claim 9, characterized in that the valve means are in the form of a non-return valve.

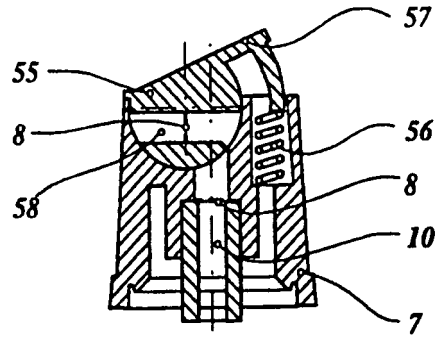
12. Foam-forming unit according to claim 11, characterized in that the non-return valve is a ball (69) biased by means of a spring (68) in a direction opposite to the intended direction of flow of foam.
- 5 13. Foam-forming unit according to claim 10, characterized in that the valve means are in the form of a rotary valve provided with return means, which valve comprises a cylindrical part (55) which has a passage (58) which through rotation can place the outlet channel (10) in  
10 communication with the environment, all in such a way that the rotary valve is opened when the control valve is moved.
14. Spray head, at least comprising a spray nozzle and a channel in communication therewith, characterized in that it comprises foam-forming means and/or valve means of the  
15 type described in one or more of the preceding claims.
15. Aerosol, at least comprising a container placed under pressure or to be placed under pressure and a foam-forming unit, characterized in that said foam-forming unit is a foam-forming unit according to one or more of claims 1  
20 - 13.



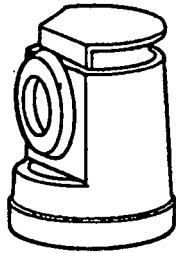
*Fig. 2*



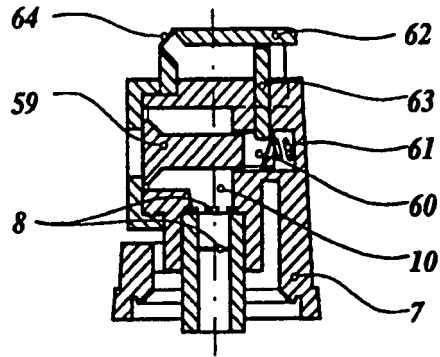
**Fig. 3a**



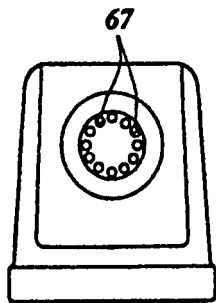
**Fig. 3b**



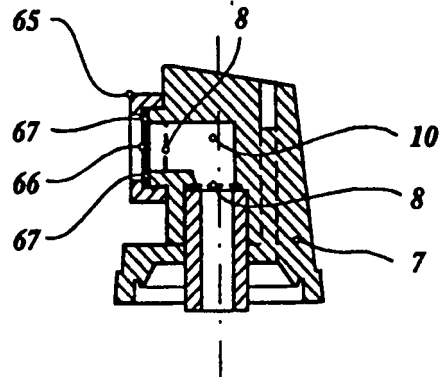
**Fig. 4a**



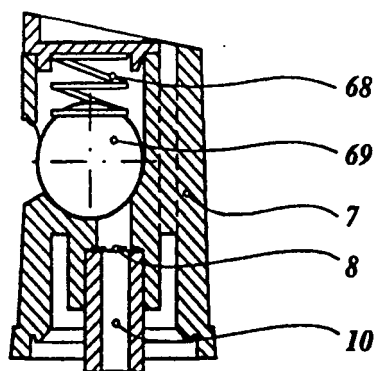
**Fig. 4b**



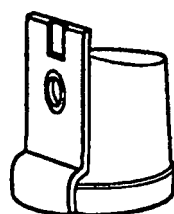
**Fig. 5a**



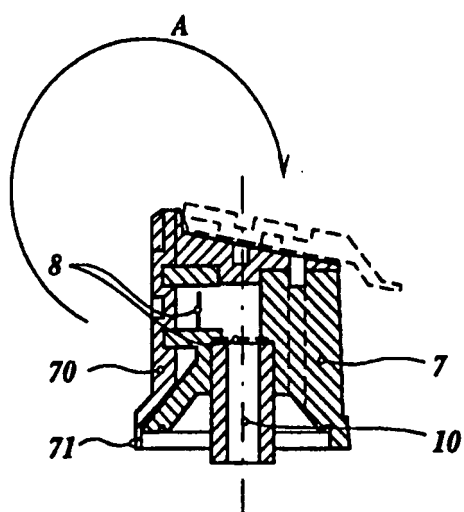
**Fig. 5b**



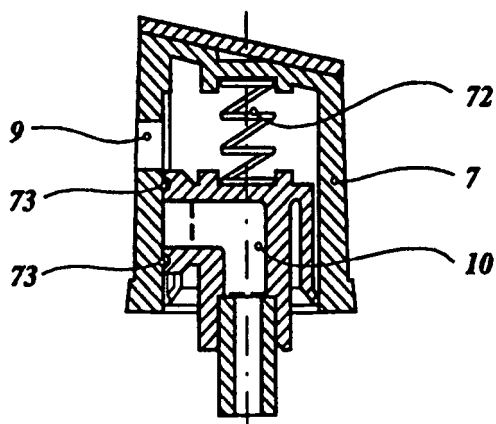
**Fig. 6**



**Fig. 7a**



**Fig. 7b**



**Fig. 8**



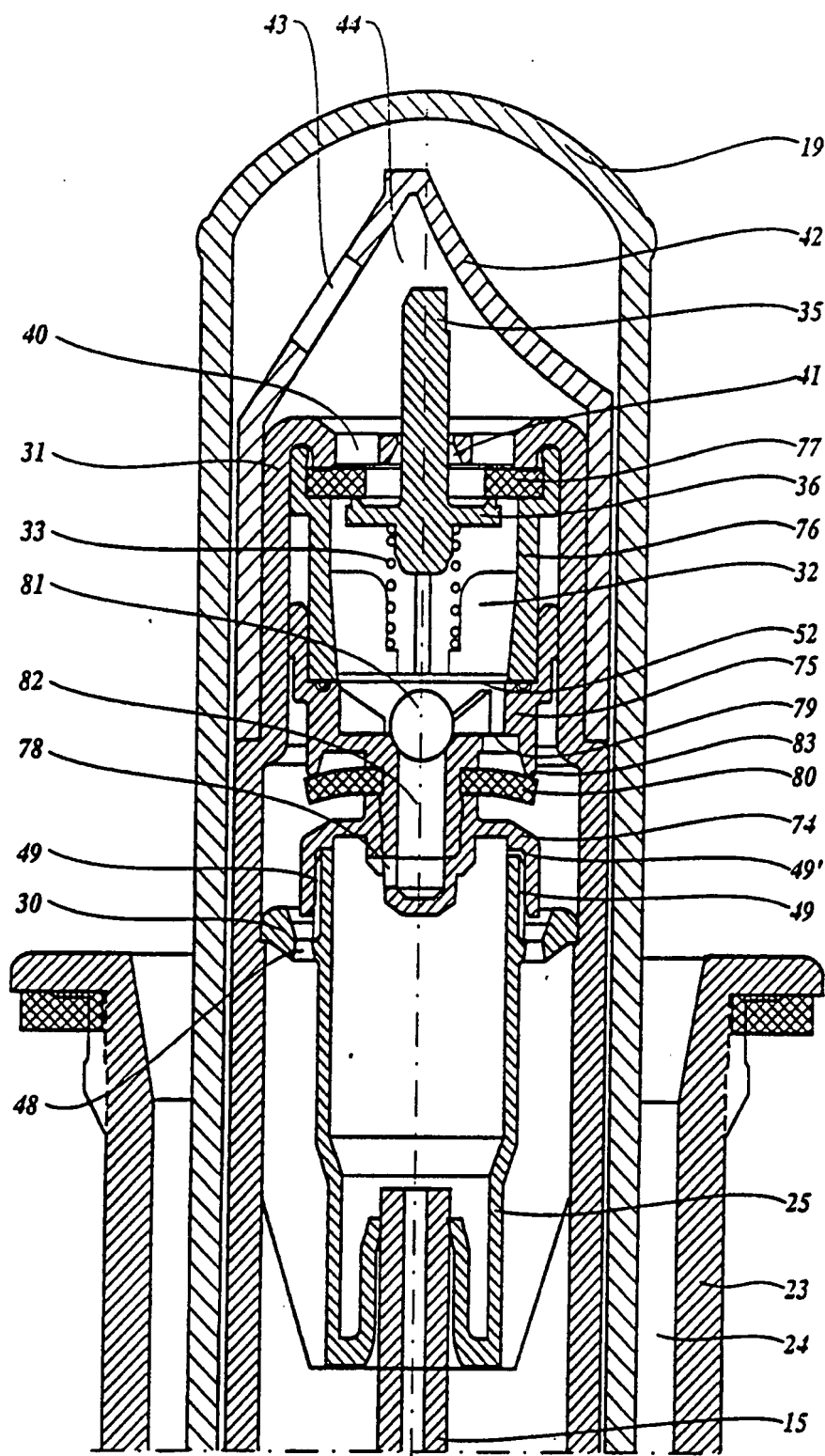


Fig. 9

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 5 B05B7/00 B05B7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 5 B05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR,A,2 206 743 (MALONE) 7 June 1974  see page 9, line 11 - page 10, line 25; figures 12-14 ---	1,2,14, 15
A	NL,A,7 705 241 (AB MALTE SANDGREN) 15 November 1977 cited in the application see the whole document ---	1,3,4,6, 7
A	EP,A,0 388 947 (DEUTSCHE PRÄZISIONS-VENTIL GMBH) 26 September 1990 see column 5, line 14 - line 47 -----	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance  
"E" earlier document but published on or after the international filing date  
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)  
"O" document referring to an oral disclosure, use, exhibition or other means  
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone  
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.  
"&" document member of the same patent family

Date of the actual completion of the international search

22 June 1994

Date of mailing of the international search report

01.07.94

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 cpo nl,  
Fax (+31-70) 340-3016

Authorized officer

Juguet, J

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR-A-2206743	07-06-74	US-A- 3955720	11-05-76
		AU-A- 6256473	31-07-75
		CA-A- 1004641	01-02-77
		DE-A, B, C 2356907	20-06-74
		JP-C- 918346	15-08-78
		JP-A- 50047211	26-04-75
		JP-B- 52049847	20-12-77
		GB-A- 1449503	15-09-76
-----			
NL-A-7705241	15-11-77	SE-B- 398980	30-01-78
		SE-B- 424962	23-08-82
		AT-B- 355980	10-04-80
		AU-B- 505855	06-12-79
		AU-A- 2489677	09-11-78
		BE-A- 854528	01-09-77
		CA-A- 1048456	13-02-79
		CH-A- 615642	15-02-80
		DE-A, C 2721128	24-11-77
		FR-A, B 2351336	09-12-77
		GB-A- 1582556	14-01-81
		JP-C- 1006049	24-07-80
		JP-A- 52138711	19-11-77
		JP-B- 54041729	10-12-79
		SE-A- 7605446	14-11-77
		SE-A- 7608916	11-02-78
		US-A- 4077442	07-03-78
-----			
EP-A-0388947	26-09-90	DE-A- 3931679	27-09-90
		AU-B- 624933	25-06-92
		AU-A- 5273790	22-10-90
		CA-A- 2028850	25-09-90
		DE-D- 59002788	28-10-93
		WO-A- 9011236	04-10-90
		EP-A- 0551146	14-07-93
		EP-A- 0550409	07-07-93
		ES-T- 2045604	16-01-94
		JP-T- 3504826	24-10-91
-----			